



## Adhesive Bonding

### Manufacturing Technologies

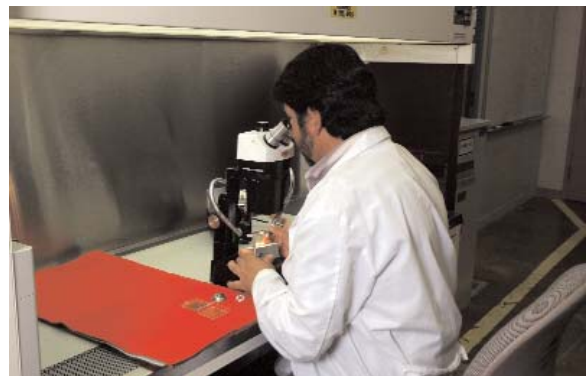
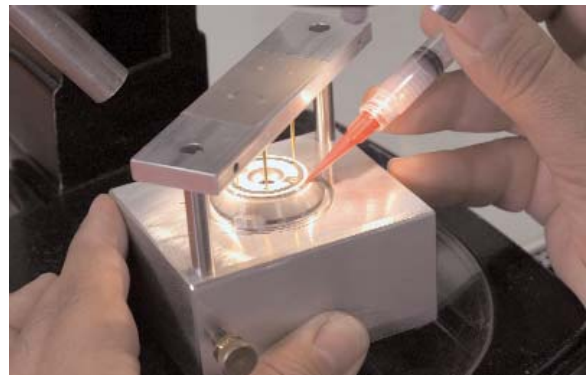
Understanding and controlling the factors that affect adhesion is vital for ensuring consistent successful bonding operations. The Manufacturing Science and Technology Center's research into adhesion is focused on achieving a good initial bond and then understanding the mechanisms leading to eventual bond failure. The department is working to understand crack propagation at the interface and has developed a variety of mechanical testing techniques to evaluate this failure mode. The factors affecting wetting and formation of the bond (e.g., contamination, surface roughness) are being explored to further our knowledge.

In addition to research into adhesion, we bond and join components for our customers. Researchers have formulated new materials that reduce or eliminate the Environmental, Safety and Health (ES&H) hazards associated with various polymer processes. The Center can help develop new bonding materials and processes, analyze existing bonds, and understand failed bonds.

#### Capabilities

- **Bonding:** Bonding operations employ thermal, anaerobic, aerobic and UV curing methods on many different geometries.

- **Materials Selection:** We routinely select materials that have the desired properties, develop processes and chemistries that are compatible with the components, and minimize environmental hazards. We also develop the assembly and tooling processes.



*Top and above: Dave Zamora performs the underfill process for attaching a thick film resistor on the MC4300 Neutron Tube*

- **Cleaning/Surface Preparation:** A variety of surface preparation techniques are used, such as solvent cleaning, plasma cleaning, sandblasting, chemical etching, and use of primers and coupling agents.
- **Adhesives Research:** We perform research into the formation of the adhesive bond interface (wetting, surface roughness, contamination) and the mechanisms for debonding.



*Rachel Giunta uses the Finetech flip-chip aligner to adhesively bond parts that require alignment to  $\pm 5$  microns*

- **Micron-scale adhesive bonding:** We offer expertise in development of processes for attaching and encapsulating micron-scale components.

## Resources

- Abrasive blasters
- Microprocessor controlled ovens
- Autoclaves up to 4 ft. diameter x 8 ft. long
- UV Curing
- Walk-in oven
- Dry wall (walk-in hood)
- Plasma cleaner

- Class 100 clean room and laminar flow hoods
- Environmental temperature cycling with optional humidity control
- Bonder with alignment to  $\pm 5$  microns
- Goniometer with environmental control, tiltable stage, and digital imaging and analysis
- JKR apparatus to measure work of adhesion

## Accomplishments

- 2002 R&D 100 Award: Developed adhesive bonding and encapsulation processes for MTR8500 Very Short Reach OC-192 Parallel Array Transponder Module.
- Developed patented adhesive bonding process for standard Electromicrofluidic Dual In-line Package.
- Material development and processing in support of assembly technologies for next-generation national security satellite needs.
- 2002 Sandia President's Gold Quality Award: Thick-film resistor attachments to the MC4300 Neutron Tube.

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